Space Weather Technical Forecast

Issued on Friday 31 January 2025 at 01:37 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares. G1 minor geomagnetic storms likely 31 Jan due to onset of CH11 fast winds.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low, with only C-class flares observed, peaking at C8.1 at 30/1416 UTC, and originating from AR3976. This is one of eight regions on the disc, the majority of which are small and simple with only limited growth. However, there is a cluster of three regions (AR3977, AR3978 and AR3976) in close proximity to each other in the NE, and these are the most active regions on the disc. They have all shown signs of growth over the past 24 hours, especially AR3976 which developed a small delta spot.

A gradual filament liftoff started in the southeast around 30/1330 UTC. An associated CME occurred, but currently appears to be slow and not Earth directed.

Solar Wind / Geomagnetic Activity: The solar wind parameters indicated the arrival of a very weak CME, possibly from 28th Jan, around 30/1430 UTC. The solar wind speed, as measured by DSCOVR at L1, remained at background levels throughout, despite a generally slightly increasing trend. Speeds started the period near 300km/s and temporarily increased to around 360 km/s. Density was average at first, but rose to be above, reaching 45ppcc. The Interplanetary Magnetic Field, Bt, increased from weak levels to become moderate and temporarily strong, peaking at 16nT at 30/1803 UTC. The north-south component, Bz, was predominantly positive until around 30/1830 UTC then fluctuated, reaching -12nT at 30/1851 UTC. Phi angle was predominately positive. Geomagnetic activity was Quiet (Kp 1-2) increasing Unsettled (Kp 3) at the end of the day.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 was at background. High energy electron flux (greater than 2MeV) at GOES16 was at Background. The associated 24-hour fluence persisted below the Active threshold, recording 1.54e6 integrated pfu at 31/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate expected, with a chance of isolated M-class flares, primarily from the regions on the northeast disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently expected, with the outlook dominated by the large recurrent coronal hole, CH11/+, in the north centre disk. The onset of a significant high speed stream (HSS) from CH11 is most likely today (31 Jan). Quiet to

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Unsettled activity (Kp 2-3) is expected initially, but increasing to give a likelihood of Active to G1/Minor Storms (Kp 4-5), and a slight chance of G2/Moderate Storms (Kp 6) through today and tomorrow (31st and 1st). Through days 3 and 4 (2nd and 3rd) activity is expected to gradually decline to Quiet to Unsettled (Kp 2-3) levels.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is expected to be at background. GOES16 high energy electron flux is expected to show a rising trend later in the period. The flux may temporarily reaching High levels, at the peak of the diurnal cycles, from day 3 (02 Feb). The corresponding 24-hour fluence is expected to remain below the Active threshold, but with an increasing trend.

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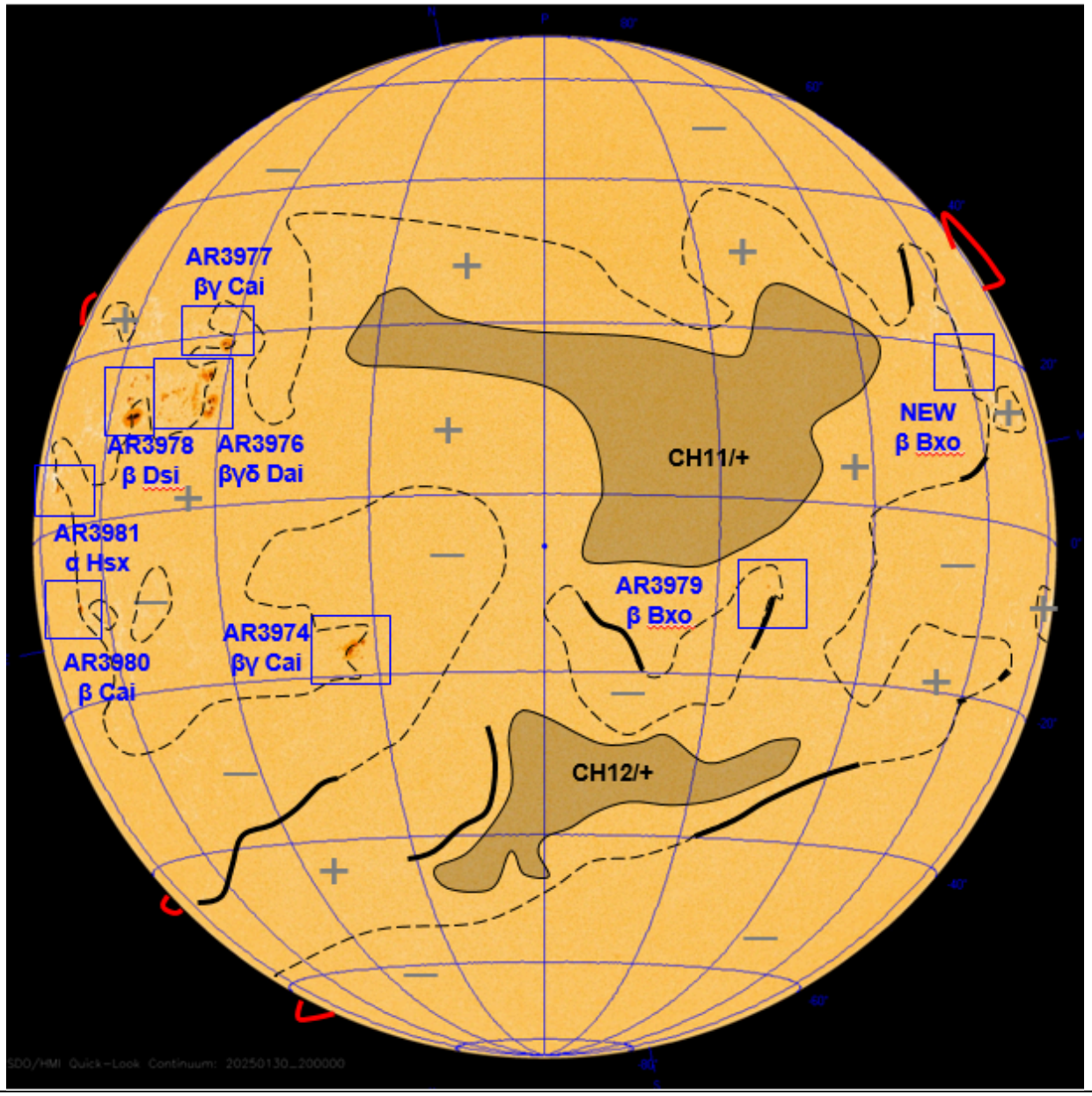
Figure 1: Synoptic Map valid 30/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

Currently no Earth-directed CMEs feature in the forecast, but modelling is awaited for the slow CME which left the Sun on the 30th in association with a filament eruption in the SE.

The current forecast is dominated by the large recurrent coronal hole, CH11/+, near centre disk. This feature is expected to bring an increase of solar winds from current background levels to eventually elevated or strong levels, 550-650km/s. This increase is likely to occur in stages over a few days, probably starting today (31st). This is supported from both recurrence and MOSWOC ENLIL model output, although MOSWOC ENLIL has been too early bringing in the HSS. Solar wind speeds are then expected to gradually decline later in the period, reaching slightly elevated levels during day 4 (3rd Feb).

Quiet to Unsettled activity (Kp 2-3) is expected initially, but increasing to give a likelihood of Active to G1/Minor Storms (Kp 4-5), and a slight chance of G2/Moderate Storms (Kp 6) through today and tomorrow (31st and 1st). Through days 3 and 4 (2nd and 3rd) activity is expected to gradually decline to Quiet to Unsettled (Kp 2-3) levels.

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	60	50	20	10
Strong	G3	No	1	1	1	0
Severe	G4	No	1	1	1	0
Extreme	G5	No	1	1	1	0

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Figure 2: Latest MOSWOC Enlil model

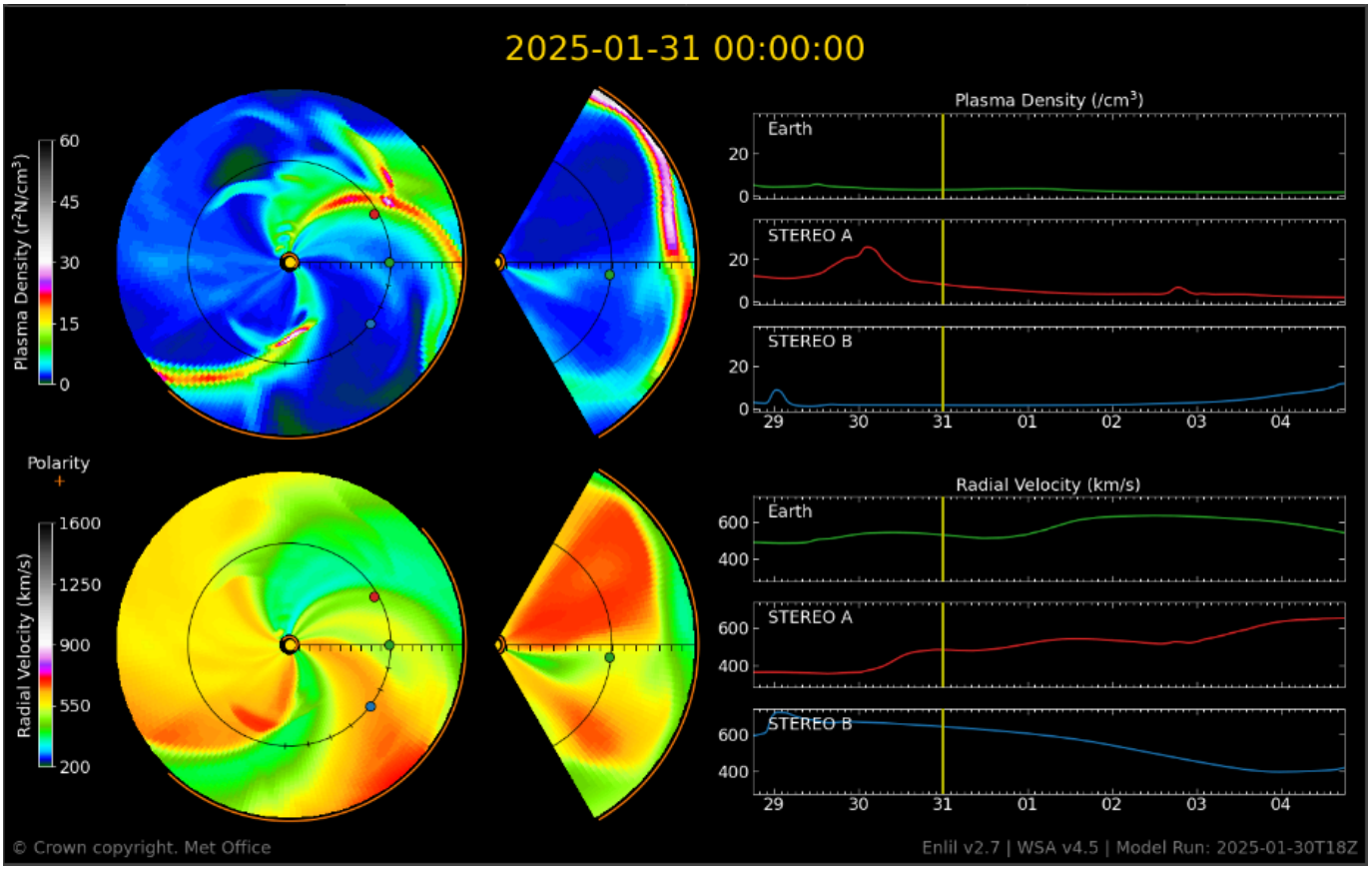

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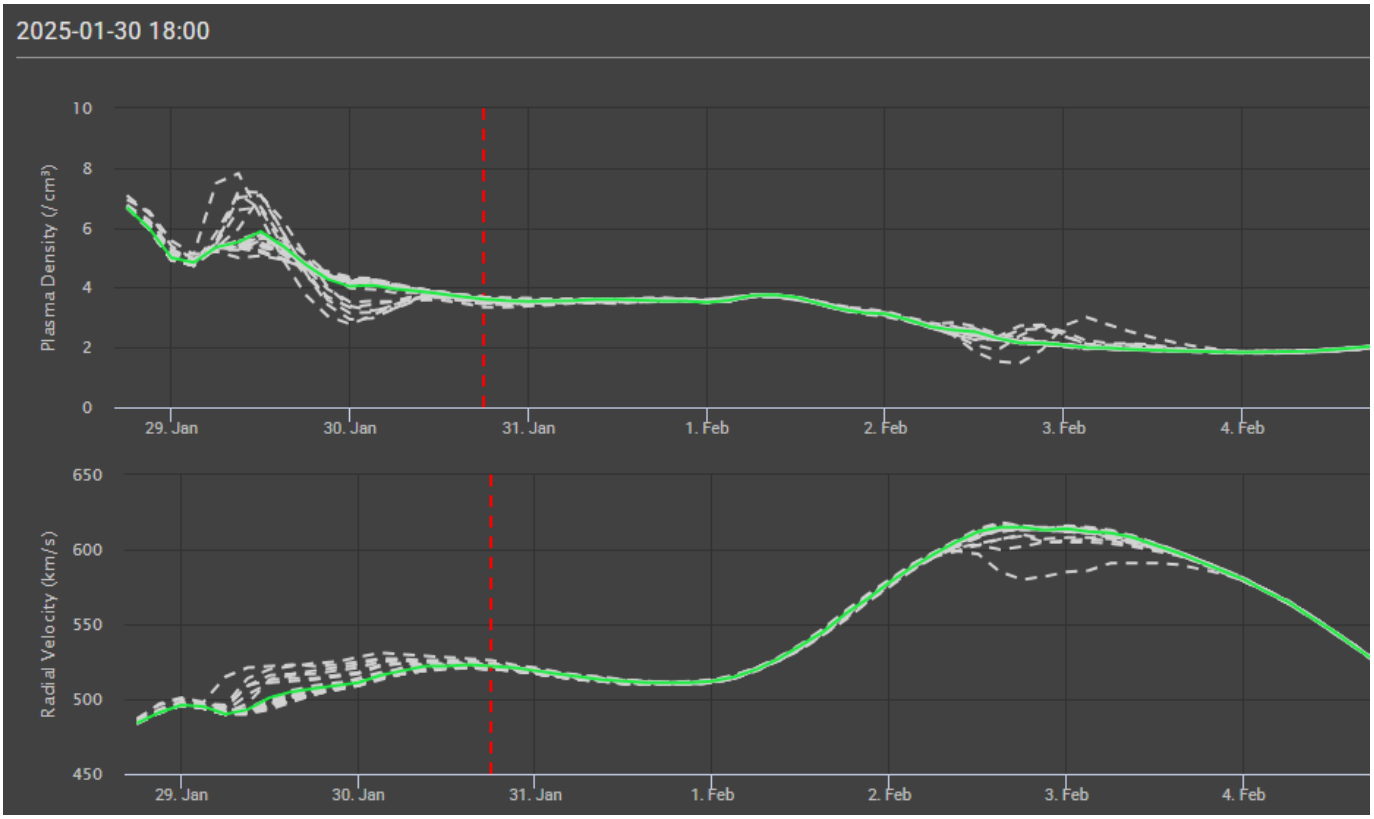
Figure 3: Latest MOSWOC Enlil Ensemble



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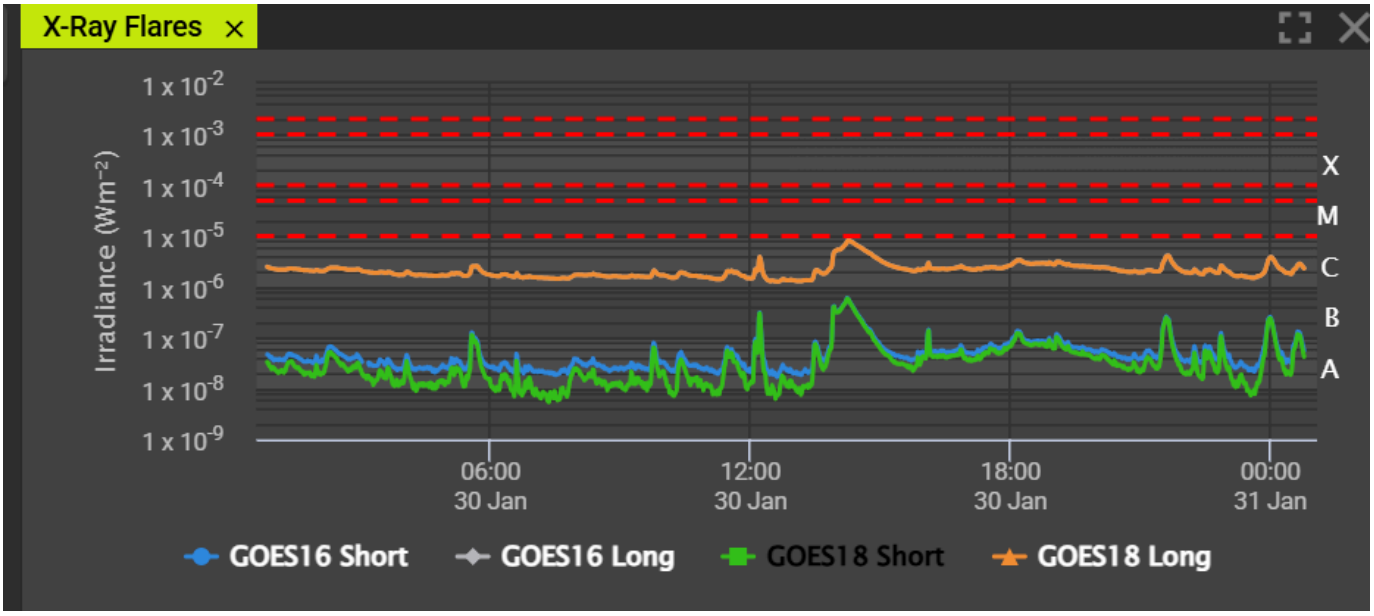
Radio Blackouts - X-Ray Flares

There are currently eight sunspot regions visible on the Earth-facing side of the Sun, with seven numbered regions including recently numbered AR3980 and AR3981, and one new simple region which has recently emerged approaching the northwest limb. AR3976, AR3977 and AR3978 are close to each other in the northeast with entwined magnetic complexity. They continue to represent the bulk of current solar activity, with some ongoing growth evident, especially within AR3876 which is now classified as Dai/beta-gamma-delta having developed a small delta spot within the main trailing group. The remaining numbered regions are mostly small, magnetically simple and show little or no changes.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	50	50	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 4: Past 24 hour GOES x-ray flux.



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Solar Radiation Storms (High Energy Protons)

Proton flux as observed by GOES-18 is currently at background and with the majority of the current solar activity on the northeast disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux observed at GOES16 has been at background and expected to persist at similar levels today and tomorrow (31 Jan-01 Feb). A rising trend is then likely, due to the charging of the Van Allen Belts from the arrival of CH11/+ fast winds. This could bring Moderate, with a chance of High flux, by the end of the period.

The corresponding 24-hour fluence is expected to remain below the Active threshold and therefore MOSWOC REFM is felt to be giving good guidance. However, a rising trend is preferred expected by day 3 (02 Feb).

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	10	30
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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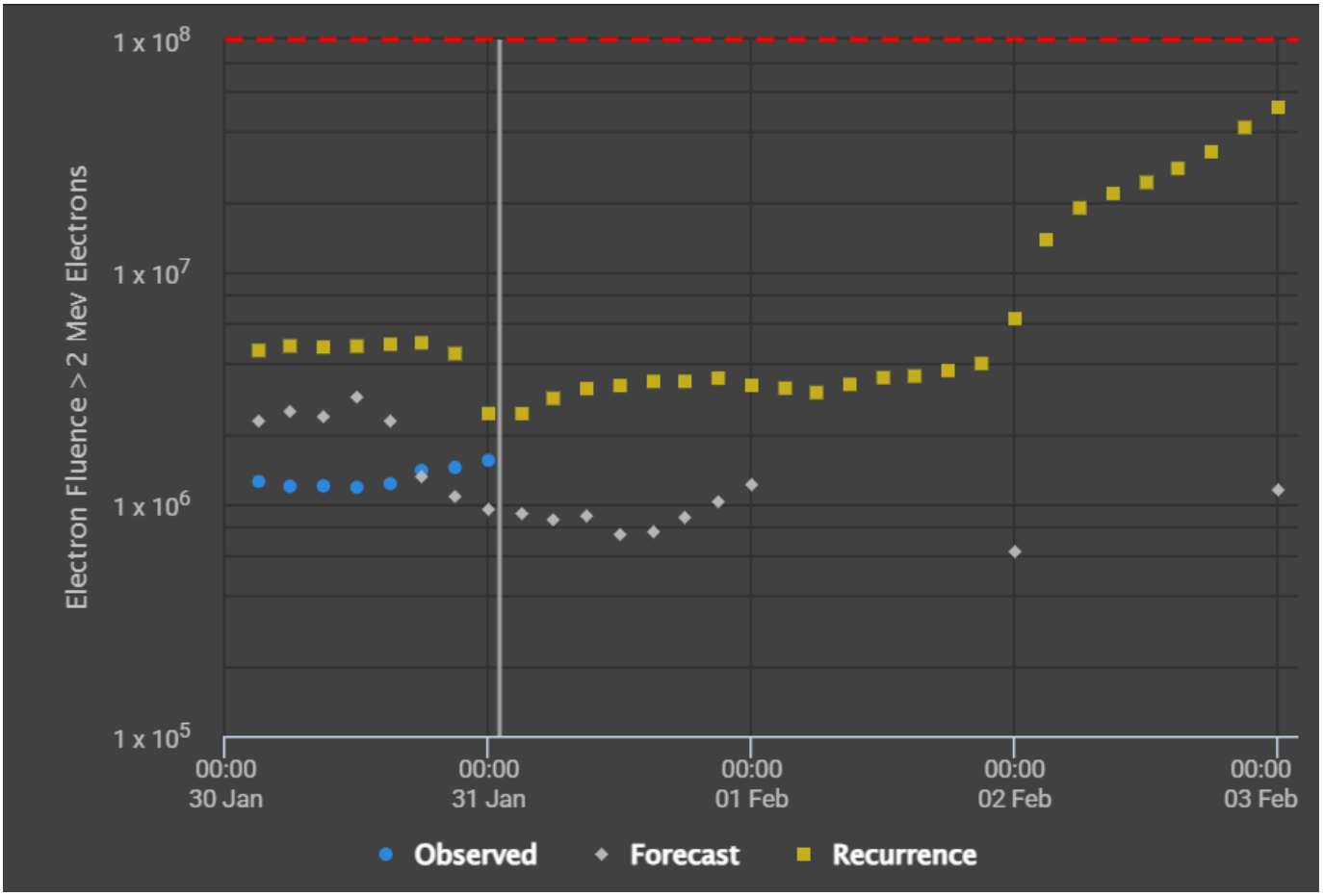
Figure 5: Latest MOSWOC REFM model.



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